

Novel Cu₆Sn₅ Thin Film Electrodes for High Performance Thin Film Batteries

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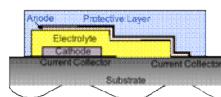
Motivation

Study new anode material systems for thin film lithium ion rechargeable batteries

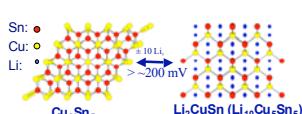
Major Accomplishments

Cu₆Sn₅ is a promising candidate anode material for thin film batteries (TFB).

Cross sectional structure of TFB*



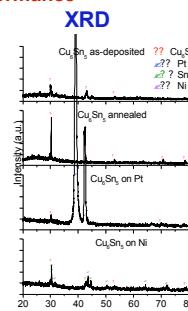
Structural Transformation



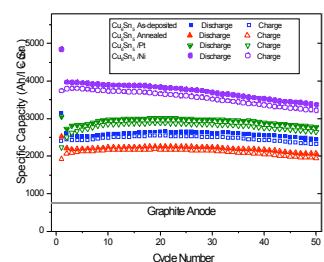
Comparison in energy storage capacity of different anode materials

Anode	Grav. Capa. mAh/g	Vol. Capa. mAh/cc	comment
Cu ₆ Sn ₅	357	2960	
Graphite	372	820	commercial anode
Li	3860	2046	Unstable
Si	3900	9080	Fade (huge vol change)
Sn	990	7230	Fade (huge vol change)

Cu₆Sn₅ film anodes were deposited by RF sputtering with or without a conductive under-layer to improve the electrochemical performance



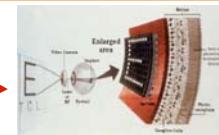
Storage capacity vs. cycle number



→ Cu₆Sn₅ anode on Pt under-layer exhibits better capacity with stability attributed to the under-layer with high electrical conductivity.

Impact

Development of new generation thin film batteries using the Cu₆Sn₅ film anode for micro or embedded batteries for electronic and medical applications

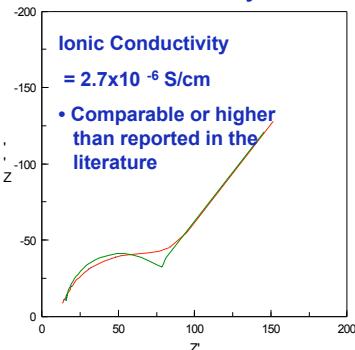


Artificial Retina

Future Work

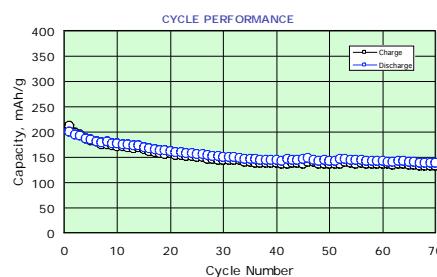
Preparation of thin films solid electrolyte with high lithium ion conductivity

LiPON solid electrolyte



Development of film Cathode for TFB

Preliminary test on LiCoO₂ film cathode



→ There are problems related to the formation of pin holes in the electrolyte and unstable capacity of cathode, which need to be solved.



I-S Kim, O. Auciello, J. T. Vaughney, J.A. Carlisle, J. Elam, M.J. Pellin, JAP to be submitted)